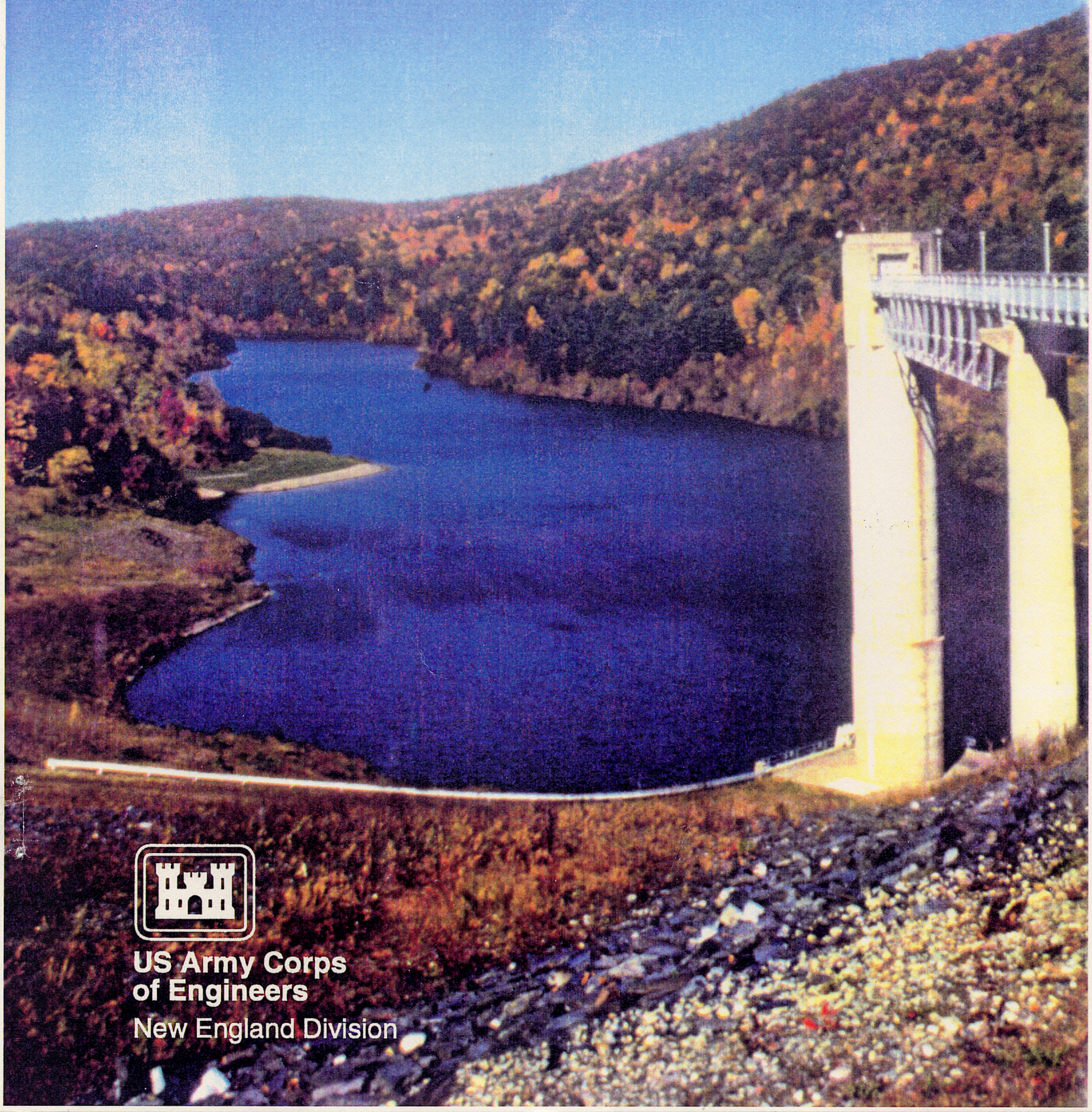
Annual Water Quality Report

Fiscal Year 1995



US Army Corps
of Engineers
New England Division

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS

WATER QUALITY CONTROL MANAGEMENT PROGRAM
ANNUAL REPORT
FISCAL YEAR 1995

JANUARY 1996

FOREWORD

This Fiscal Year 1995 Annual Water Quality Report of the New England Division is prepared in response to OCE requirements set forth in ER 1130-2-334 (30 April 1987 version). Information contained herein will update that presented in the FY77 report, the original response to the ER, and that presented in subsequent annual reports prepared from FY78 through FY94. Duplication of previous information has been kept to a minimum.

Mr. Townsend Barker of the Environmental Engineering and Hydraulics Branch prepared this report and is available to provide additional information on areas of further interest (telephone 617-647-8621). A listing of Water Quality Control Management reports prepared to date is included in Appendix A.

NEW ENGLAND DIVISION
WATER QUALITY CONTROL MANAGEMENT
ANNUAL REPORT
FISCAL YEAR 1995

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NEW ENGLAND DIVISION
WATER QUALITY CONTROL MANAGEMENT PROGRAM
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1. GENERAL BACKGROUND

The New England Division (NED), Corps of Engineers has completed 35 dams, 5 hurricane barriers, and 93 local protection projects within the New England area. Figure 1 shows locations of the dams. In addition, NED has acquired flowage rights on more than 8,000 acres of floodprone Massachusetts lands within the Charles River Natural Valley Storage area. All local protection projects, four dams, and three hurricane barriers have been turned over to local interests, and the remainder are operated and maintained by NED. Most construction prior to 1955 was authorized for flood control purposes only; however, approval has been given for other uses at many of NED's older reservoirs, due to development of new water resource needs in the basins. Most of the newer projects have been designed for more than flood control storage, e.g., recreation, conservation, and low flow augmentation; furthermore, Littleville and Colebrook River Lakes have significant water supply storage. Hydropower facilities have been constructed at seven sites on Corps-owned lands; however, these are designed, built, operated, and maintained by private interests not connected with the Corps.

Although water quality management is not a defined purpose at any project operated and maintained by NED, the Corps has a long-standing, strong interest in water quality. Executive Order 11752, "Prevention, Control, and Abatement of Environmental Pollution at Federal Facilities," 19 December 1973, makes it a stated national policy that the Federal Government, in the design, construction, and operation of its facilities, shall provide leadership in the nationwide effort to protect and enhance the quality of our air, water, and land resources. Section 102b, of the Federal Water Pollution Control Act Amendments of 1972 places responsibility with EPA for determination of the need for, the value of, and the impact of storage for water quality control in reservoir projects constructed after 1972. Responsibility for water quality management at Corps projects, however, clearly rests with the Corps since it is an integral part of our water control management activities. To meet this responsibility, area-wide water quality management programs must be established, specific water quality objectives for each reservoir project developed, and procedures implemented to meet these objectives. To ensure success, continual collection and evaluation of water quality data and reporting of water quality management activities are necessary. The Annual

NED RESERVOIR PROJECTS INCLUDED IN ITS WATER QUALITY MANAGEMENT PROGRAM

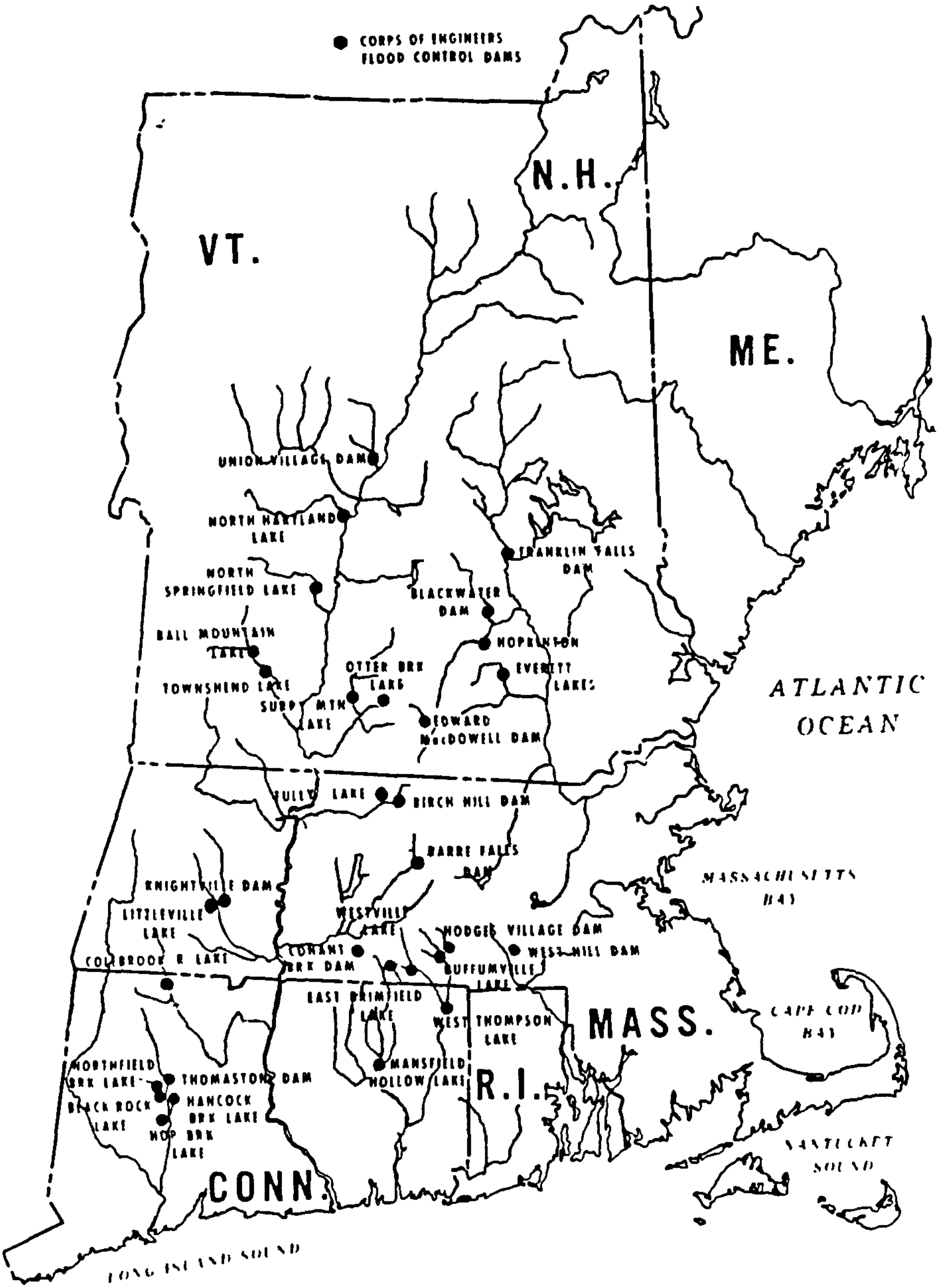

FIGURE 1

Water Quality Reports, required of each Corps Division, are part of that program of evaluation and reporting.

The NED reservoir water quality control management program has multiple goals. Its primary purpose is to protect public health and safety, but additional goals include meeting State water quality standards, maintaining water quality suitable for all project purposes, and understanding the effects of project operations on water quality. The Master Water Control Manual for each basin includes the goals and objectives for the water quality program. Appendix B contains a copy of the most recent Division Water Quality Regulation.

The annual report is a summary of water quality conditions and activities during the year. In addition to meeting reporting requirements of OCE, it is a valuable tool for reviewing the past year's program and charting the course for the following year. This report is not limited only to activities under the Corps Reservoir Water Quality Operations and Maintenance Program, but also includes other Corps water quality activities and concerns related to various studies, investigations, and designs.

2. SUMMARY

The FY95 (1 October 1994 through 30 September 1995) NED reservoir water quality control management program was basically the same as presented in the FY94 Annual Water Quality Report (AWQR). Total program size was equal to $297,000, a cut of 9 percent from the previous year. No changes were made in the basic structure of NED's classes I, II, and III water quality classification system (described in Appendix C). The water quality team formed in 1982, with representatives from Engineering and Operations Directorates, continued setting direction for the overall water quality program and coordinated all its elements.

FY95 was a dry year for New England. Drought conditions prevailed over most of New England from February through September, with precipitation deficits ranging from 7 to 10 inches and no significant runoff events. At two NED projects, releases were requested because of low riverflows: American Optical Company requested releases from storage at East Brimfield Lake, and the Connecticut Bureau of Fisheries requested Colebrook to release water from storage during July, August, and September. Although no hurricanes hit the New England area, the tropics were extremely busy with 19 named tropical storms formed during the 1995 June to November season. Only three of these storms came close enough to New England to cause heavy surf advisories, but brought no heavy rain.

Effects of these weather patterns on water quality included low streamflows, warm water temperatures, and reduced dissolved oxygen levels. The generally dry conditions during the summer resulted in few beach closings from high bacteria; this was not surprising as it is usually after rainstorms have washed animal wastes off the land and into rivers that coliform counts rise at Corps beaches. Northfield Brook Lake in Connecticut was closed once following heavy rainfall in late July.

By most other measures, FY95 was a fairly typical year for water quality conditions at NED projects. Nuisance blue-green algae blooms were observed at West Thompson Lake in Connecticut, and transient coliform contamination was detected at drinking water wells at a few projects. Otherwise, water quality continued good to excellent with most concerns caused by external phenomena, such as acid precipitation or upstream point source discharges. By "good water quality" we mean the water generally met or exceeded State standards, and was suitable for its intended use. Table 1 contains current NED classifications of existing reservoir projects; these are the same as presented in the FY94 AWQR. State water quality classifications are listed in Appendix D.

Water quality activities performed by NED in FY95 under the Reservoir Water Quality Operation and Maintenance Program included:

- Potable water and bathing beach water quality monitoring.

- Baseline monitoring of classes I and III projects without permanent pools.

- EPA priority pollutant scans at Buffumville Lake, and Hodges Village Conant Brook, and West Hill Dams in Massachusetts; and Colebrook River, and West Thompson Lakes in Connecticut.

- Completion of a report on fish contamination at West Thompson Lake in Connecticut.

- Study of relationship between rainfall and bacteria contamination at NED beaches.

- Investigation of silt release at Ball Mountain Lake in Vermont.

TABLE 1
NED RESERVOIR PROJECT CLASSIFICATION
1 JANUARY 1996

Class III	Class II	Class I
Four projects with definite water quality problems.	Eleven projects with minor or suspected water quality problems.	Sixteen projects with no significant water quality problems.
Two Lakes	Nine Lakes	Ten Lakes
Hop Brook, CT	North Hartland, VT	Ball Mountain, VT
West Thompson, CT	Edward MacDowell, NH	North Springfield, VT
	Everett, NH	Townshend, VT
	Hopkinton, NH	Otter Brook, NH
	Buffumville, MA	Surry Mountain, NH
	East Brimfield, MA	Tully, MA
	Littleville, MA	Black Rock, CT
	Westville, MA	Colebrook River, CT
	Northfield Brook, CT	Hancock Brook, CT
		Mansfield Hollow, CT
Two Dry Bed Reservoirs	Two Dry Bed Reservoirs	Six Dry Bed Reservoirs
Union Village, VT	West Hill, MA	Blackwater, NH
Birch Hill, MA	Thomaston, CT	Franklin Falls, NH
		Barre Falls, MA
		Conant Brook, MA
		Hodges Village, MA
		Knightville, MA

- Analysis of movement of PCB-contaminated sediments at Birch Hill Dam.

Water quality activities performed in FY95 as part of other studies, investigations, and designs include:

- Completion of spill prevention, control, and countermeasure plans and spill contingency plans for NED's 31 flood control reservoirs, the Charles River Valley Natural Storage Project, and the Stamford hurricane barrier.

- Investigation and remediation of iron bacteria problems at the Charles George Superfund site.

- Completion of design studies for restoration of the Galilee salt marsh.

- Initiation of feasibility-level water quality improvement studies for the Muddy River.

- Completion of initial studies for restoration of six areas of salt marsh on Cape Cod.

- Completion of assistance to Regulatory Division on groundwater studies at the Mashantucket Pequot tribal reservation in southeastern Connecticut.

- Assistance to the New Bedford Superfund site with solids removal problems at the water treatment plant.

- Completion of a draft report on plans to restore the Sagamore salt marsh.

- Provided assistance in a study of water quality in constructed wetlands in a storm water detention basin.

- Evaluation of environmental impacts associated with Department of Defense Environmental Restoration Program, and Environmental Protection Agency Superfund hazardous and toxic waste studies and designs.

- Investigations of four abandoned landfills at three NED projects.

NED Environmental Laboratory completed reconstruction in FY95 and regained all of its previous capabilities lost in a disastrous fire in late 1993.

Water quality personnel at NED attended and participated in conferences and meetings on a variety of water quality and environmental issues. NED also continued coordinating with Federal, State, and local officials regarding mutual water quality concerns. In an effort to promote information exchange, copies of this report are being provided to relevant State and Federal agencies and interested private parties.

3. RESERVOIR WATER QUALITY OPERATION AND MAINTENANCE PROGRAM

a. Water Quality Team. NED's water quality team, established in 1982 with members from Engineering and Operations Directorates, continued functioning smoothly in 1995. Regular meetings throughout the winter and early spring enabled the team to plan the 1995 reservoir water quality program. Additional meetings during the summer and fall as needed, coordinated the ongoing program. Mr. Bruce Williams represented Operations Directorate; NED's Environmental Laboratory was represented by Mr. Kenneth Levitt, with assistance from Mr. Peter Trinchero. Mr. Townsend Barker of the Environmental Engineering and Hydraulics Branch continued as Engineering Directorate's representative on the team.

b. Environmental Engineering and Hydraulics Branch (EEHB). Table 2 presents a current organizational listing of personnel involved in executing the NED reservoir water quality program. Mr. Alexander Olewicz, a chemical engineer, completed the NED Intern Training Program and joined EEHB full time in FY95. In January, Mr. Charles Wener, Chief of EEHB, began a 1-year temporary duty assignment in Engineering Management Division; during his absence, Messrs. Donald Wood, Ian Osgerby and Townsend Barker alternated as Acting Branch Chief. In March, Ms. Betsy Marangoly joined EEHB as a chemical engineer intern after completing her CO-OP program. Ms. Vicki Volz began a 9-month temporary assignment to assist Project Management Division with the Stratford Superfund site in May. Ms. Janice Vatland, an undergraduate student at MIT, worked as a summer hire. Also, Dr. Osgerby was selected as NED's Innovative Technology Advocate.

Table 3 contains a summary of experience levels of members of the water quality team, and the principals involved in carrying out the water quality and environmental engineering program.

c. Potable Water Quality Monitoring. NED monitors 50 drinking water wells at 24 reservoir projects on a regular basis. In accordance with requirements of the Environmental Protection Agency's "Total Coliform Rule," sampling frequency is based on expected monthly usage as predicated from past records. Biweekly, monthly, or quarterly samplings are called for during the recreation season. Drinking fountains

TABLE 2

RESERVOIR WATER QUALITY CONTROL MANAGEMENT PROGRAM
PRIMARY PARTICIPATING ELEMENTS - JANUARY 1996

ENGINEERING DIRECTORATE
WATER CONTROL DIVISION

McMillan, F.	Supvy Hyd Eng

Environmental Engineering

Wener, C.	Supvy Hyd Eng
*Barker, T.	Hyd Eng
Wood, D.	Hyd Eng
Volz, U.	Hyd Eng
Sullivan, H.	Hyd Eng
Osgerby, I.	Chem Eng
Olewicz, A.	Chem Eng

ENGINEERING DIRECTORATE
GEOTECHNICAL ENGINEERING DIVISION

Singh, H.	Chief

Environmental Laboratory

Carroll, M.	Director
Knowles, F.	Chief Chemist
Saner, W.	Q.A. Officer
Levesque, L.	Financial Asst
Rogowski, G.	Chemist
Koenig, M.	Chemist
Lubianez, D.	Chemist
Slepski, A.	Chemist
Miller, D.	Chemist
*Levitt, K.	Biologist
*Trinchero, P.	Biologist
Amidon, N.	Phys Sci Tech
Lundquist, R.	Phys Sci Tech
Miller, K.	Phys Sci Tech
Bouchard, K.	Phys Sci Tech
Johnson, V.	Phys Sci Tech
Heitmann, K.	Phys Sci Tech
Reagan, W.	Phys Sci Tech
Henderson, W.	Phys Sci Tech
Hale, C.	Phys Sci Tech
Gamache, P.	Computer Asst
Gamble, L.	Office Automation Clerk
Alger, J.	Office Automation Clerk
Martin, M.	Office Automation Clerk

OPERATIONS DIRECTORATE
OPERATIONS TECHNICAL SUPPORT DIVISION

Boutillier, C.	Supvy Civ Eng
*Williams, B.	Park Manager

* Participate directly on Water Quality Team

NOTE: Mr. R. Reardon, Director of Engineering, and Mr. J. Wong, Director of Operations. Coordination and water control assistance was provided by the Reservoir Control Center.

TABLE 3

WATER QUALITY STAFF EXPERIENCE

EMPLOYEE	POSITION TITLE	GRADE	YEARS OF EXPERIENCE	AREAS OF EXPERTISE
Amidon, N.	Physical Science Technician	GS-9	9	Sample collection, HTW
Barker, T.	Hydraulic Engineer	GS-12	20+	Water chemistry, computer modelling, environmental engineering, hydrologic engineering
Levitt, K.	Biologist	GS-11	12	Fisheries biology, limnology, aquatic microbiology
Olewicz, A.	Chemical Engineer	GS-11	3	Chemical engineering
Osgerby, I.	Chemical Engineer	GS-13	20+	Chemical engineering, computer modelling
Sullivan, H.	Hydraulic Engineer	GS-11	3	Environmental engineering, computer modelling, hydrologic engineering
Trinchero, P.	Biologist	GS-11	20+	Fisheries biology, limnology, aquatic microbiology, ecology
Williams, B.	Park Manager	GS-12	16	Wildlife biology, wetlands, environmental compliance and restoration
Wood, D.	Hydraulic Engineer	GS-12	20+	Environmental engineering, computer modelling, hydrologic engineering

at NED's recreation areas are open from approximately the third Saturday in May to the weekend after Labor Day. Monitoring could vary on a monthly basis according to the actual number of visitors expected. However, for simplicity's sake, sampling at each project, during the recreation period, was set according to the expected maximum monthly attendance for the year. During the remainder of the year, wells kept open for project personnel are monitored quarterly. Monitoring for other parameters is performed as required by the States where the wells are located. Table 4 contains a summary of the projects, by state, where NED monitors potable water quality.

Drinking water standards require less than one total coliform bacteria per 100 ml. Wells showing possible contamination are closed, chlorinated, flushed, and retested. If retesting shows the well to be safe, it is reopened. However, wells may also be closed for other reasons, including excessive turbidity or noncoliform bacteria.

Wells at Ball Mountain, North Springfield, and Townshend Lakes and Union Village Dam in Vermont; Hop Brook and West Thompson Lakes in Connecticut; and Surry Mountain Lake in New Hampshire had unacceptable levels of coliform bacteria during one or more samplings in FY95. For most, retesting after chlorination showed safe conditions, and none tested positive for E. coli. Total coliforms were commonly found after work had been performed on the wells or water lines, and the system had not been thoroughly chlorinated and cleaned.

At Hop Brook Lake, two wells had coliform contamination when tested in May. There were large leaks in the lines from wells HB-DW-5 and 6, and coliform bacteria were believed to be entering through them. The systems were not successfully repaired and were out of service for the remainder of the 1995 recreation season.

Well SM-DW-1 supplies the utility building at Surry Mountain Lake. In late summer and fall 1991, the well repeatedly tested positive for coliforms for reasons that were never discerned; the well was quite deep and there were no obvious breaks in the line or sources of groundwater contamination. The following spring the well tested clean, and except for one high count in the fall of 1994, there were no problems until this year. In the spring of 1995, intermittent positive counts were found, and by midsummer the positive counts became continuous; however, in no case were E. coli. present. The system has been repeatedly examined, but the source of the problem has not been identified. Water from this well is not used by the public, and project personnel use it only for washing, so no health threat is involved. We are continuing to investigate the problem.

TABLE 4

POTABLE WATER QUALITY MONITORING AT NED RESERVOIR PROJECTS

	Wells Monitored
Vermont	
Ball Mountain Lake	6
North Hartland Lake	2
North Springfield Lake	2
Townshend Lake	3
Union Village Dam	2
New Hampshire	
Blackwater Dam	1
Edward MacDowell Lake	2
Everett Lake	1
Hopkinton Lake	2
Otter Brook Lake	2
Surry Mountain Lake	2
Massachusetts	
Barre Falls Dam	2
Birch Hill Dam	1
Buffumville Lake	2
Knightville Dam	3
Littleville Lake	1
Tully Lake	1
West Hill Dam	3
Connecticut	
Colebrook River Lake	1
Hop Brook Lake	4
Mansfield Hollow Lake	1
Northfield Brook Lake	2
Thomaston Dam	2
West Thompson Lake	3

As reported in the FY94 AWQR, well NB-DW-3 at Northfield Brook Lake had been repeatedly testing positive for coliform bacteria although it was a relatively new well and drilled deep. The problem appeared to be related to a poor fit to the casing cover, allowing debris to enter and contaminate the well. There have been no findings of contamination in more than a year since the cover was fixed, and the problem has been successfully corrected.

d. Bathing Beach Water Quality Monitoring. Thirteen swimming areas at 13 NED reservoirs were operated by the Corps in 1995. Table 5 contains a summary of projects, by State, where water quality for bathing is monitored by NED.

TABLE 5

BATHING BEACH WATER QUALITY MONITORING
AT NED RESERVOIR PROJECTS

Vermont	Locations Monitored
Ball Mountain Lake	1
North Hartland Lake	1
North Springfield Lake	1
Townshend Lake	1
Union Village Dam	1
New Hampshire	
Hopkinton Lake	1
Otter Brook Lake	1
Surry Mountain Lake	1
Massachusetts	
Buffumville Lake	1
West Hill Dam	1
Westville Lake	1
Connecticut	
Hop Brook Lake	1
Northfield Brook Lake	1

Beaches maintained by NED are monitored biweekly during the recreation period which runs from about the third weekend in May until Labor Day. Experience has shown that bacteria counts tend to rise after rainstorms. Consequently, in 1994, NED began doing extra monitoring of selected projects following rainstorms, to develop a database for predicting how long beaches will need to be closed. This is important because the *Enterococcus* test required for Connecticut beaches takes two days. We also hope knowledge derived from this database will make it possible to reduce baseline monitoring at beaches.

The number of regularly monitored beaches at Union Village Dam in Vermont was reduced from 3 to 1 in 1995. The East and West Branches of the Ompompanoosuc River meet within reservoir lands behind the dam, and there had been NED-monitored swimming areas on the East Branch and main stem. All these beaches were within a couple of miles of each other. Conditions at these beaches are highly transient, because they are little more than water holes in the river with minimal hydraulic detention times. Consequently, it was decided that the most upstream station on the East Branch would sufficiently represent conditions at all beaches.

Monitoring at the unofficial swimming area at Tolles Dam at North Springfield Lake was dropped in 1995. There were no changes in beach monitoring stations at other projects.

Bacteria counts in excess of the single-sample standard were recorded at Hop Brook and Northfield Brook Lakes, Connecticut; Otter Brook and Surry Mountain Lakes, New Hampshire; and Ball Mountain and Townshend Lakes, and Union Village Dam in Vermont during FY95. Most of these resulted in no more than temporary closures of a couple of days before bacteria counts returned to normal. Northfield Brook Lake was closed for four days at the end of July following heavy rains. Surry Mountain and Townshend Lakes and Union Village Dam also reported high counts from this late July storm.

Union Village Dam had repeated high bacteria counts during the summer of 1994. The reason for these elevated counts was never positively identified, but believed to be runoff from localized thunderstorms. No particularly heavy rain was recorded at the project during this period, and the project manager did not observe any unusual occurrences in the watershed which could explain the repeated high counts. There were, however, a series of thunderstorms almost every week; when these occur, the streams run "like chocolate milk," according to the basin manager. This indicates storms were washing material into the rivers, and it is likely these materials contained large amounts of bacteria. Significant rainfall was not recorded at the project office during these events, indicating thunderstorms were very localized. A somewhat similar situation apparently caused beaches at this project to be closed for most of the second half of August 1993.

These problems recurred during the summer of 1995. An investigation of the watershed by the NED Lab, including repeated bacteria sampling, located the possible source of the problem. Barker Brook enters the East Branch about a mile upstream from the Union Village Dam project limits. Its headwaters flow through a grazing field for 30 or 40 cattle, and these animals have direct access to the brook. This appears to explain why bacteria counts are so high following even small storms, and why counts remain high for a long time afterwards. This information was given to the project manager who took it to the local Health Department, as the Corps has no authority in areas outside the Union Village Dam project limits.

Beach monitoring in FY96 is expected to be the same as in FY95 with biweekly monitoring of all projects, supplemented with additional sampling following heavy rains.

e. Baseline Fixed Station Monitoring. In order to use resources efficiently, while meeting requirements to monitor water quality trends and changes at Corps projects, NED splits its baseline water quality program into high and low level monitoring. Briefly, the difference between these two levels is in the statistical certainty of results. High level baseline monitoring involves a higher level of statistical certainty, and a larger number of samples than low level monitoring. The NED Annual Water Quality Report for 1990 contained a detailed explanation of the statistical basis used for selecting sampling frequency for water quality monitoring at NED projects.

Low level baseline monitoring was performed in 1994 at the nine class II projects with conservation pools, and six class I dry-bed reservoir projects. Class II projects are those with only minor water quality problems, and enough data have been collected over the years so that annual monitoring is not required. Class I projects have generally high water quality and no known water quality problems. Only minimal data are required for these projects to check for changes and monitor trends. Baseline data collection was last performed at these class II projects in 1991, and at the dry-bed class I projects in 1992. At each project, 2 to 4 stations were sampled three times from April through September. Parameters analyzed included field parameters (DO, pH, temperature, conductivity, turbidity), nutrients (ammonia, nitrite plus nitrate, total phosphorus), bacteria (fecal coliforms, Enterococci, or E. coli., depending on the State), and such trace metals as have shown up in the past or for which there is a concern.

Class III projects are those with continuing water quality problems, and receive more frequent and intensive sampling than class I or II projects. In 1995, there were two class III projects without conservation pools, Union Village and Birch Hill Dams, and baseline data collection at these projects was last performed in 1993. Samples were collected from inflow and discharge stations three times from April through October. Parameters analyzed included field parameters (DO, pH, temperature, conductivity, turbidity), nutrients (ammonia, nitrite plus nitrate, total phosphorus), Enterococci bacteria (Union Village), fecal coliforms (Birch Hill) and trace metals.

Data collected in 1995 at these projects will be used to update their respective water quality reports. This work is scheduled for later in fiscal year 1996.

f. <u>EPA Priority Pollutant Scans</u>

(1) <u>General</u>. Contaminants are an area of great concern to the Corps nationwide. In response to ETL 1110-2-281 "Reservoir Contaminants," dated 17 June 1983, Major General Wall's 3 June 1983 letter on "Potential Contamination of Corps Reservoirs," and Brigadier General Kelly's 6 May 1986 letter on the same subject, many Corps Divisions have tested for the full range of EPA priority pollutants at all their projects. NED began performing priority pollutant scans in 1987, when the NED Lab achieved the ability to perform analyses for organic compounds on the priority pollutant list. Hopkinton Lake and Birch Hill Dam were the initial projects studied. NED intends to perform similar scans at all projects eventually.

(2) <u>West Thompson Lake</u>. In FY95, EEHB completed a report on the West Thompson Lake priority pollutant scan. Samples collected from West Thompson Lake on 23 September 1993 were analyzed for PCBs, dioxins, pesticides, metals, and volatile and semi-volatile organic compounds. Total organic carbon and grain size analyses were also performed to characterize the sediment samples. This report examined measured levels of these contaminants and compared them to available information on standards and background levels.

Results showed no significant levels of these contaminants in water samples, but sediments at West Thompson Lake might be contaminated with heavy metals, pesticides, and dioxins and furans. Levels of these substances did not pose any direct threat to humans, but the report recommended fish be examined to confirm that significant bioaccumulation was not occurring. PCB levels appeared to indicate lightly contaminated conditions that were not a major concern at this project. No volatile and only one semi-volatile organic compound was found at a level high enough to be of concern, but that appeared to be the result of laboratory contamination rather than an actual high level in sediment.

Based on preliminary results from this priority pollutant scan, fish samples were collected and their tissues analyzed for contaminants. Results are discussed in paragraph 3h.

(3) 1995 Work. A concentrated effort was made to collect samples and perform priority pollutant scans at the remaining NED projects in 1995. By the end of FY95, samples had been collected at Buffumville Lake, and Hodges Village, Conant Brook, and West Hill Dams in Massachusetts; and Colebrook River and West Thompson Lakes in Connecticut. When those projects are completed, only Black Rock and Hancock Brook Lakes in Connecticut; Tully Lake in Massachusetts; Everett and Surry Mountain Lakes and Blackwater Dam in New Hampshire; and Ball Mountain, Townshend Lakes, North Hartland, and North Springfield Lakes in Vermont will still lack formal scans. A formal priority pollutant scan has never been performed at Union Village Dam in Vermont; however, sediments at that project have been analyzed in connection with studies of effects of upstream acid mine drainage.

(4) Summary. Table 6 gives a summary of NED reservoir projects where priority scans have been performed and the year samples were collected and analyzed.

g. Movement of PCB-Contaminated Sediment at Birch Hill Dam. As explained in the FY94 Annual Water Quality Report, sediments at Birch Hill Dam in central Massachusetts are contaminated with PCBs from an unidentified past upstream discharge. NED has been studying the project to determine the extent of contamination, whether PCBs are moving or being buried by sedimentation, and the best means to deal with them.

The work of previous years included sampling to determine the highest levels of contamination, and computer modelling of river shear stresses to determine areas of erosion and deposition under varying flow regimes. In 1995, sampling was conducted to determine the extent of contamination in river sediments. Grain size analyses of sediments were also performed to confirm and improve results of computer modelling of river erosion characteristics.

TABLE 6

PRIORITY POLLUTANT SCANS
AT NED RESERVOIR PROJECTS

	Year Samples Collected
New Hampshire	
Blackwater Dam	1995
Edward MacDowell Lake	1995
Everett Lake	1995
Franklin Falls Dam	1993
Hopkinton Lake	1987
Otter Brook Lake	1991
Surry Mountain Lake	1995
Massachusetts	
Barre Falls Dam	1993
Birch Hill Dam	1987
Buffumville Lake	1995
Conant Brook Dam	1995
East Brimfield Lake	1994
Hodges Village Dam	1995
Knightville Dam	1990
Littleville Lake	1990
West Hill Dam	1995
Westville Lake	1994
Connecticut	
Colebrook River Lake	1995
Hop Brook Lake	1991
Mansfield Hollow Lake	1993
Northfield Brook Lake	1989
Thomaston Dam	1991
West Thompson Lake	1993
Vermont	
Ball Mountain Lake	1995
Townshend Lake	1995

The intent of this work was to define the extent of potential problems. If it is determined that significant amounts of PCBs exist in reaches shown to be erosion sites under high flow conditions, and there are no practical means of removing or stabilizing them, it may be desirable to further define their erosive characteristics.

Data collected in FY95 will be analyzed in FY96. Results will be used in determining the next phase of action.

h. West Thompson Fish Tissue Study. Preliminary analysis of priority pollutant scan data from West Thompson Lake (see paragraph 3f(2) showed that metals and organic compounds might be present in sediments at concentrations high enough to cause contamination in fish. Consequently, in FY94, NED sampled a selection of fish from the project to screen for contamination and, in FY95, EEHB completed a report on that work.

While it was finally concluded that no contaminants were at levels of concern in the fish, determining the level of concern was not simple for many parameters. This report examined measured levels of contaminants in fish at West Thompson Lake and compared them to available information on standards and background levels.

It was important that results be comparable to other sites in the State; consequently, decisions on sampling procedures were strongly influenced by procedures of the State of Connecticut. The Connecticut Department of Public Health (CTDPH) determines the safety of fish in their waters through risk assessments. Typically, they collect 18 to 20 fish from a site, and take the five largest for analysis. These fish are analyzed individually, unless a screening was being performed, in which case they were composited.

CTDPH typically uses white suckers for analysis because they are ubiquitous and a large amount of data is available for them. NED decided to analyze common game fish at West Thompson Lake in addition to white suckers, because predators like largemouth bass tend to have higher levels of certain contaminants such as mercury.

Risk assessments are for human consumers; therefore, the edible fish portions were analyzed. The Food and Drug Administration defines the edible portion as the scaled fillet with the skin on, except for bullheads and eels whose skin is removed.

(1) Conclusions. The CTDPH has the responsibility for determining whether contaminants in fish pose a threat to

human consumers, and they have concluded advisories are not necessary for West Thompson Lake. Based on EPA risk assessment guidance, mercury and PCB levels in some of the sampled fish appear to be high enough to warrant restrictions on meals, at least by women of child-bearing age. However, levels are low and near background levels compared to fish from typical Connecticut Lakes. The CTDPH is considering a State wide advisory on consumption of certain types of freshwater fish by pregnant women, but does not consider levels of PCBs and mercury at West Thompson Lake to be of particular concern. There are no indications that contaminants in fish are a threat to piscivorous wildlife, or the fish themselves. Contaminant levels in the fish appear to be stable, and no significant changes are expected unless conditions in the lake or watershed change.

(2) Metals. Sediment metal levels (with the possible exception of mercury) appear to have minimal effects on levels in fish, because sediment levels are generally low and the metals tend to be in insoluble compounds. Furthermore, sediment metal levels are likely to be reduced in the future. There were many upstream waste discharges that were poorly treated or untreated in the past; however, these are now all either discontinued or treated. Consequently, metals deposited in sediments in past years should be gradually covered with cleaner sediments, and metals levels in fish should stay the same or be further reduced in the future.

(3) Dioxins. FDA action limits were exceeded for total dioxin in one white sucker with 31 ppt, which was slightly greater than the action limit of 25 ppt. CTDPH uses toxicity equivalency factors to evaluate a mixture of dioxins, rather than looking at just the total concentration. By this method, dioxin levels in all West Thompson Lake fish were low and not a concern. FDA action levels were not exceeded for any other measured contaminant.

(4) Pesticides. All measured pesticide levels were below detection limits. Typically, pesticide levels in Connecticut fish are low, and it is very rare for them to be high enough to warrant an advisory on fish consumption.

(5) Effects on Wildlife. Eisler reports were used to evaluate contaminant hazards to wildlife from mercury and chromium. The largemouth bass composite had a mercury level just over the 0.1 ppm limit recommended to protect piscivorous birds; however, other levels were low and it was concluded that mercury was not a threat to fish or the wildlife predators that eat them. As reported by Eisler, a standard for chromium in fish flesh, or even water, is difficult to defend, as chromium is an essential trace element for some

animals, including humans. Eisler presents some rough guidelines, and by these measures, chromium levels in West Thompson Lake fish are not a problem for fish or the animals that eat them.

(6) Bioaccumulation Potentials. Theoretical bioaccumulation potentials (TBPs) can be estimated for nonpolar organics from the sediment concentration of total organic carbon and the compound of concern, and the lipid concentration in fish. Comparisons of TBPs with measured levels of PCBs and dioxins indicate concentrations of these contaminants in fish were near equilibrium with those in sediments. Therefore, higher levels of these contaminants in fish are not likely to be found in the future, unless conditions in the lake change. If nonequilibrium conditions were observed, it would indicate a recent change in sediment concentrations, and that contaminant levels in fish might be in the process of changing.

i. Beach-Rainfall Study. As explained in the FY94 Annual Water Quality Report, NED is trying to improve safety at its beaches and reduce sampling by trying to understand the relationship between storms and high bacteria counts. To this end, intensive sampling of selected beaches following storms causing significant runoff began in FY94. The intention of this work was to determine how long after rainstorms the bacteria counts at beaches would exceed standards.

Projects chosen for this study were Hop Brook and Northfield Brook Lakes in Connecticut, Surry Mountain Lake in New Hampshire, and Townshend Lake in Vermont. Samples were collected on the day a significant rainfall ended, and continued daily until the beach passed, and generally for another 3 days afterwards.

First year results from this study did not work out as desired. There were no beach closures at Townshend or Surry Mountain Lakes, while a series of unusually heavy rainstorms caused prolonged beach closures at Hop Brook and Northfield Brook Lakes. An absence of rain during much of the second year of study prevented the collection of as much data as had been expected; however, there were some events at Hop Brook, Northfield Brook, and Townshend Lake which may give very useful results.

A preliminary report is scheduled for later in FY96 summarizing findings from the first two years of study. Intensive sampling of beaches, following rainfall events, will likely be continued in the hope of obtaining results that can be used for administrative closures following more typical storms.

j. Ball Mountain Lake Silt Problems. The West River in Vermont is an important part of the program to restore Atlantic salmon to the Connecticut River. In order to allow salmon to get past two Corps dams--Ball Mountain and Townshend Lakes--the Corps has installed upstream passage facilities for adults, and modified the project operation to allow downstream passage of smolts. Ball Mountain Lake is normally maintained at a depth of 65 feet in the spring and summer, in part because the valley behind it is so narrow and the watershed so flashy that it is difficult to maintain a shallower pool. However, in order to allow downstream fish passage in the spring, the pool needs to be held to 25 feet or less. Because of the difficulty in maintaining such a pool, especially during a time of high runoff, an automatic gate was installed; however, this did not entirely solve the problem.

Twice in 1993, the automatic gate malfunctioned causing large amounts of sediment, which had accumulated behind the dam, to wash into the river. Much of this material settled in the West River within two miles of the dam, an area where high quality trout habitat could be seriously affected. The sediment does not kill fish directly, but can smother aquatic insects they eat. Although some sediment movement occurred continuously, this important section of the river was not flushed clean until the spring runoff in 1994. Ultimately, the sediment was deposited in Townshend Lake where it is of less concern, because it does not change the character of the benthic environment.

Another accidental sediment washout occurred in the early morning hours of 5 June 1995. The sensor which ran the gate was out of operation because of clogging by sediment accumulated against the gate house, and the project was being operated manually. At the time of the 1995 release, project personnel were keeping the pool as close to the 25-foot stage as possible, to allow downstream migration of salmon smolts. A thunderstorm on Saturday, 3 June, caused the pool to rise over the 30-foot stage, and a gate increase was made Sunday afternoon to lower the pool; however, the gate opening was overestimated. On Monday morning, 5 June, the pool stage was recorded between 17 and 18 feet, and a large amount of sediment behind the dam was exposed and washed through the gates.

On 8 June 1995, a team from the EEHB, NED Lab, and Ball Mountain Lake visited the West River to evaluate effects of this sediment. Purpose of this trip was to provide an assessment of effects of this sediment on salmonid (salmon and trout) habitat, and to determine if there were practical options for flushing the sediment. They concluded that the amount of material washed out was much less than what occurred two years earlier; however, it was still a large amount of sediment and the extent of adverse effects on salmonid habitat was similar. They also concluded it would take a large event, such as a spring freshet, to wash the sediment out of the salmonid habitat areas and into Townshend Lake, and that attempts to store and release water at Ball Mountain Lake would not be effective.

Normally, the streambed below the dam consists of gravel and cobbles; however, sediment had filled spaces between rocks. Deposits of silt and sand became less evident along the banks moving downstream, but there was a fine deposit of silt over most of the rocks, especially in pool areas. This silt would have smothered and killed the aquatic insects such as caddisflies that salmonids feed on, and inhibited the recolonization of the rocks by those insects. The sediment release would not kill fish directly, but would kill their food source, causing the fish to eventually starve or move downstream in search of better habitat.

About 1-1/2 miles downstream from the dam, there was the first evidence of caddisfly survival. At the bridge entering Jamaica State Park, about two miles below the dam, one-half the river was unaffected by the recent sediments.

Fine sediment deposits could be seen in the river at road crossings down to the East Jamaica bridge, above Townshend Lake. However, there was no evidence this material had come from Ball Mountain Lake as opposed to other sources in the watershed. Ball Mountain Lake does not generate silt; it washes in from the watershed, and there is a significant amount of West River watershed between Ball Mountain and Townshend Lakes.

Drawdown of Ball Mountain Lake revealed that sediment had built up virtually to the 20-foot stage. It appeared that much, if not most, of the sediment washed out two years ago had been replenished. Two years ago, the pool dropped to the 6.4-foot stage and a much greater amount of sediment went through the gates.

k. <u>FY95 Reservoir Water Quality Concerns</u>. NED rated water quality at most of its reservoirs during FY95 as good to excellent, because it usually met State standards and was usable for its intended purposes. External phenomena including acid rain, urban runoff, wastewater treatment plant discharges, and natural watershed conditions were primary causes of water quality concerns. Corps project operations do not adversely affect water quality at any NED reservoirs.

Table 7, a summary of water quality concerns at NED projects in FY95, shows many projects with high levels of metals, color, nutrients, turbidity, and coliform bacteria; and low levels of pH and DO. However, some things need explaining lest this table presents an unrealistically bad impression of water quality conditions. What the table lists are water quality concerns -- these are not necessarily all problems. For example, most metals listed have been found only rarely at levels above criteria necessary to protect aquatic life. Furthermore, these criteria were taken from the literature -- not studies of project conditions and resident aquatic life. Only at Union Village Dam, Vermont, is there any evidence of metals adversely affecting aquatic life, and the effects appear minor. Metals at Union Village Dam originate in acid mine drainage from abandoned copper mines upstream from Corps project boundaries. At the remaining NED projects, metals appear to be the result of upstream wastewater discharges, or natural watershed conditions and effects of acid rain. Mercury is a concern at all NED projects; however, mercury contamination of fish is a problem for all New England States, and large sections of the rest of the country. The widespread nature of the mercury problem is due to much of its origin being in atmospheric deposition. Most color, iron, manganese, and some low pH levels originate in swamps and marshes in the watersheds. Acid rain is suspected of being responsible for very low pH levels. High nutrient levels originate primarily in agricultural runoff and wastewater treatment plant discharges. Erosion in watersheds, and algae blooms in reservoirs, are sources of high turbidity at NED projects. Urban runoff, wastewater treatment plant discharges, and agricultural runoff produce high coliform bacteria counts. Low DO levels are due to natural watershed conditions and excessive algae and aquatic macrophyte growth.

1. <u>Continuing Water Quality Problems</u>. There are four reservoir projects, operated and maintained by NED, that have continuing water quality problems: Hop Brook and West Thompson Lakes in Connecticut, Birch Hill Dam in Massachusetts, and Union Village Dam in Vermont. This section summarizes the problems, and how NED is addressing them.

(1) <u>Hop Brook Lake</u>. This project has chronic high bacteria counts and algae blooms, causing the popular beach to be closed often to swimming. These problems originate in land-use practices outside the borders of Hop Brook Lake. Consequently, NED is trying to involve State and local agencies to take actions such as checking for failing septic systems, and helping farmers use good agricultural practices. Additionally, NED is planning sedimentation basins on tributary streams to intercept suspended sediment containing the

TABLE 7

NED RESERVOIR WATER QUALITY CONCERNS FY95

Project	Low pH	High pH	Low DO	High P	High N	High Color	High Turbidity	High Bacteria	High Metals	Other Concerns	Suspected Contributing Sources
Birch Hill, MA	X		X	X	X	X	X	X	Hg,Cu,Al	PCBs	WWTP discharges, Acid rain
Buffumville, MA	X	X	X	X				X		Aquatic weeds	WWTP discharges, Acid rain
East Brimfield, MA	X	X	X	X						Aquatic weeds	Swamps & marshes, Acid rain
Ed. MacDowell, NH	X		X						Hg		Acid rain
Everett, NH	X		X						Hg		Acid rain
Hop Brook, CT	X	X	X	X	X	X	X	X	Al,Hg	Algae blooms	Urban runoff, Sewage overflows, Acid rain
Hopkinton, NH	X		X								WWTP discharges, Acid rain
Littleville, MA	X								Hg,Fe,Mn	Discharge temperature	Acid rain
Northfield Brk, CT	X		X	X	X			X	Hg	Algae blooms	Acid rain
North Hartland, VT		X		X	X		X	X	Hg,Al		WWTP discharges
Thomaston, CT				X	X			X	Hg,Cd,Cu, Pb,Al,Zn		WWTP discharges, Acid rain, Urban runoff
Union Village, VT		X					X	X	Hg,Cd,Cu, Zn,Al,Fe	Acid mine drainage	Abandoned copper mines, Farm runoff
West Hill, MA	X		X					X	Hg,Cd,Al		WWTP discharges, Landfill leachate, Acid rain
West Thompson, CT	X	X	X	X	X	X	X	X	Hg,Cd,Al Pb	Algae blooms, Pest., Organics	WWTP discharges, Acid rain
Westville, MA	X		X	X				X	Al		WWTP discharges, Acid rain

phosphorus which fuels algae blooms. Finally, because lake bacteria counts tend to rise after heavy rains, the relationship between runoff and bacteria levels is being studied to develop protocols to maximize the amount of time the lake can safely be open.

(2) West Thompson Lake. This lake has severe annual algae blooms which look nasty and disrupt its ecosystem. NED is gathering data on the source of the excess phosphorus fueling these blooms. If, as suspected, the Southbridge wastewater treatment plant is the principal source, collected data will be presented to the State and EPA when that treatment plant's discharge permit is up for renewal, to encourage a requirement for phosphorus removal.

(3) Birch Hill Dam. Sediments at this project are contaminated with PCBs. NED is involved in a multiyear study of contaminated sediment movements, and uptake of PCBs by biota. Findings are being fully coordinated with other interested agencies and private parties. These studies will determine the extent of the problem, and the best means for dealing with it.

(4) Union Village Dam. Acid mine drainage, from abandoned copper mines in the watershed outside Corps project limits, interferes with benthic habitat, and colors the river red during high runoff events. As the mines are not on Corps property, NED has no control over them. However, when possible through programs of technical assistance to the States, NED has studied the mine drainage problems and outlined methods to stabilize the tailings piles which cause most of the problems. NED will continue to look for ways to encourage and assist the owners and State to take actions to minimize acid mine drainage from the sites.

m. FY96 Reservoir Water Quality Management Activities. The exact form of NED's FY96 Reservoir Water Quality Management Program will be determined by the water quality team in mid-winter, based on a close analysis of data collected in FY95. The anticipated FY96 program will cost an estimated $249,000 (a reduction of 16 percent from the FY95 program, and a 35 percent reduction since FY93), and cover a wide variety of studies. Work items likely to be included are (1) baseline fixed station monitoring at class III projects with, and class II projects without, permanent pools, (2) continuation of the bathing beach and potable water quality monitoring, (3) EPA priority pollutant scans at one or more projects, (4) a fisheries assessment at Surry Mountain Lake in New Hampshire (5) study of movement of PCB-contaminated sediments at Birch Hill Dam, Massachusetts, and (6) continued investigation of the relationship between rainfall and bacteria levels at beaches, to develop better means of determining when to close and reopen swimming areas.

4. OTHER WATER QUALITY STUDIES, INVESTIGATIONS, AND DESIGNS PERFORMED IN FY95

a. Spill Control Plans. The response by personnel at flood control projects to oil or hazardous material spills can mean the difference between a safely executed emergency operation and serious injury or death. Such incidents may occur on a flood control project or close enough to threaten it. Spills may occur as a result of an accidental release of materials stored or used at a project, industrial and transportation accidents, or illegal disposal. Appropriate responses to incidents require identifying the hazardous substances, implementing preventative measures, planning for an emergency, and training in execution of the plans.

As an essential first step in preparation for an incident, Spill Prevention, Control, and Countermeasure Plans and Spill Contingency Plans were completed for each of NED's 31 flood control reservoirs, the Charles River Valley Natural Storage Project, and the Stamford Hurricane Barrier in FY95. These plans provide for an efficient, coordinated, and effective response to oil and hazardous substance discharges, and also address the prevention of such discharges. Included in each plan is a description of the project, responsibilities of NED and project personnel, potential spill hazards at the project, and procedures to prevent and control spills. Training requirements are included, as well as recommendations on how the project can improve its prevention of and response to spills of oil and hazardous substances. These plans are required by 29 CFR, and authorized by ER 500, section 11.

Plans were produced incorporating the combined talents of chemical and environmental engineers. New England's Regional Administrator of the Environmental Protection Agency approved these plans without substantive changes, and with a letter of approval and commendation from the agency. EEHB is currently preparing a training program to implement requirements under these plans as defined by Federal regulations.

b. Iron Bacteria at Charles George Landfill. The Charles George Landfill is a 70-acre municipal and industrial waste landfill located in Tyngsborough, Massachusetts. Unrecorded quantities of organic and metal hazardous liquids and sludges were disposed of there from 1973 to 1976. In 1981, EPA classified Charles George landfill as a Superfund site, and remedial actions began in 1983.

Included in the cleanup plan is a groundwater and leachate collection and treatment system. Groundwater is collected in wells and pumped to a lagoon, where it is stored until a temporary treatment system is brought in to treat the water so it can be discharged. Temporary systems are periodically used while a permanent treatment system is designed and constructed. Problems have arisen because some extraction wells have been producing much less than design flow rates, and the treatment system has had difficulty producing acceptable water quality.

EEHB's Dr. Osgerby led an investigation into the treatment system and poor performance of the extraction wells in the east and southwest boundaries of the landfill. The root cause of problems was discovered to be a massive infestation of iron bacteria. These organisms caused a wide variety of operational problems, including clogging of wells and piping with bacterial slimes and precipitated iron; and creation of anaerobic conditions under which nitrogen-fixing and sulfur-reducing bacteria thrive, especially in the storage lagoon. These nitrogen and sulfur bacteria increase levels of ammonia and hydrogen sulfide which are toxic to aquatic life. Ammonia has increased so much that it is the principal toxicant that would be discharged if the water is not properly treated.

The well field has undergone a rehabilitation process, as a first step in a regular program of well maintenance, under guidance of the Corps of Engineers Waterways Experiment Station (WES), utilizing a Daytona, Florida contractor specializing in this type of work. The lagoon is routinely pumped out to provide renewed storage volume of the extracted water from the wells and reduce the generation of ammonia and hydrogen sulfide. EPA has made it clear they want EEHB's chemical engineers to participate in design of the treatment plant, because of the quality of work they have come to expect from EEHB, and their ability and commitment to provide EPA with practical, and timely engineering services. As part of this design process, EEHB recently developed a laboratory setup to do bench-scale treatability tests for the lagoon water. Successful development of this innovative, comprehensive attack on the bacterial contamination problem was a result of a collaboration among the chemical, environmental, geotechnical, and geological engineers at NED and WES, as well as the biologists at the NED Environmental Laboratory.

c. <u>Galilee Salt Marsh Restoration</u>. As described in the FY94 Annual Water Quality Report, Section 1135 of the Water Resources Development Act of 1986, as amended, gives the Corps authority to modify projects, completed before 1986, for environmental restoration. An example would be restoration of a wetland that had been filled with dredged material.

Historically, the 128-acre Galilee Bird Sanctuary in south-central Rhode Island was mostly salt marsh. However, disposal of dredge material from Corps navigation projects partially filled western sections of the marsh, and construction of a road with minimal culvert openings by the Rhode Island Department of Transportation (RIDOT), significantly restricted tidal flow to eastern parts of the marsh. Today, less than 20 acres of salt marsh and open water remain. The sanctuary is listed as a priority focus area under the Atlantic coast joint venture of the North American Waterfowl Management Plan.

In 1994, a feasibility study was completed of restoring salt marsh affected by disposal of material from Corps dredging projects, and the accompanying water quality improvements which would be brought about by increased tidal flushing. In addition to removing dredge material fill, the report recommended increasing tidal exchange by installing culverts, and adding self-regulating tide gates to these culverts to prevent flooding of homes and roads during severe tidal events. The plan would restore about 34 acres of salt marsh.

In 1995, the project moved into the design phase to make final determinations of culvert sizes, invert elevations, and the necessary amount of dredging to restore filled in marsh channels. In addition, RIDOT requested the Corps to determine culvert sizes required to restore a similar area of salt marsh in the eastern portion of the sanctuary. Sizing of culverts and tide gates for this area was also completed in FY95. Construction for eastern and western restorations is expected to begin in 1996.

d. <u>Muddy River Water Study</u>. The Muddy River, a minor tributary to the Charles River, is located within a series of Boston area parks referred to as the "Emerald Necklace," designed by the 19th century's most famous landscape architect, Frederick Law Olmsted. Although it begins in the clean, spring-fed waters of Jamaica Pond, water quality along most of its length is very poor due to uncontrolled urban drainage and cross connections to sanitary sewers. In addition, the small drainage area, minimal channel slope, and presence of a series of small ponds, minimize flushing. These conditions have resulted in the buildup of large areas of septic sediment which further degrade water quality. In FY93, NED completed a reconnaissance study which documented water quality along the length of the river and provided a preliminary evaluation of potential solutions.

In 1995, the study moved into the cost-shared feasibility stage. A storm water management model (SWMM) is being used to evaluate upstream loads and sources, and a water quality model (CEQUAL-ICM) to evaluate water quality improvement alternatives in the river. Graduate students from Northeastern University are assisting the study by analyzing sediment oxygen demand, and some means for instream treatment. Principal options being considered, in addition to ending illegal cross connections, are flow augmentation from various sources, and dredging sediments. Treatment alternatives are being examined, but appear to produce only limited localized improvements. The feasibility study report is scheduled for completion in mid-FY96, when it will be presented to the State and communities of Boston and Brookline.

e. Cape Cod Coastal Wetlands Investigation. In cooperation with the Coastal America Initiative, NED looked at six wetlands where areas of salt marsh were suspected to have been reduced by road or railroad crossings with small culvert openings. Wetlands involved were Bridge Creek in Barnstable, Freemans Pond in Brewster, Bridge Street and Cold Storage Road in Dennis, Route 6 in Eastham, and Kildee Road in Harwich. For each wetland, EEHB observed the extent of the restriction caused by the culvert by monitoring water levels during a spring tide. Then EEHB estimated the area of marsh affected by restrictive culvert openings, areas of potential flood damages if the culvert restriction were removed, and other factors potentially affecting water quality and salt marsh environment. In addition, the necessary studies were outlined to design the necessary culverts to restore the salt marsh without causing flood damages. A draft report was completed in FY95, and the final report will be issued in FY96.

f. Assistance to Regulatory Division. In FY95, EEHB completed its assistance to Regulatory Division with groundwater studies at the Mashantucket Pequot tribal reservation in southeastern Connecticut. The sand and gravel operation, which began in the 1980s, resulted in the filling of wetlands and triggered actions by NED's Regulatory Division. The tribe is genuinely concerned about the environment and has shown an interest in doing more than the minimum required. They worked out acceptable plans to restore the lost wetlands, but rapid development associated with the Foxwoods Casino threatened the viability of the restoration.

Extensive development at Foxwoods created a need for large amounts of potable water. After extensive testing, the most promising site for additional wells was near the wetland to be restored, and there was concern that drawdown from the wells would cause severe harm. Tribal representatives were studying effects of the proposed wells using the groundwater computer program MODFLOW and pump tests. Regulatory Division was not familiar with MODFLOW and requested EEHB to review the work.

Mr. Barker of EEHB began meeting with the tribe's hydrogeologist in November 1993, and had additional meetings to review results and discuss plans for continued studies, until September 1995. At a meeting that month, the tribe's representatives proposed a different approach to the study. Instead of relying on computer results, they proposed to determine pumping effects by direct field observations on test restorations during pumping at maximum expected rates. Evaluation of results for this new direction of the study does not require assistance from EEHB, and no further involvement is expected.

g. Assistance at the New Bedford Superfund Site. For approximately one month in early FY95, EEHB's Alex Olewicz worked at the New Bedford Harbor Superfund site to gain field experience and use his chemical engineering background to help solve operational problems at the treatment plant. Located in southeastern Massachusetts on the west side of Buzzards Bay, New Bedford Harbor is on the banks of the Acushnet River. Its sediments are highly contaminated from past industrial discharges, especially PCBs. At the request of EPA, NED has been overseeing cleanup operations.

The major part of the cleanup involves dredging and treating Acushnet River sediments. These sediments are dewatered prior to incineration, and the drained water is treated to remove suspended sediments and their adsorbed contaminants.

Problems were encountered in the treatment process for this water. Solids removal percentages were less than designed, but it was not clear whether the problem was the pH, temperature, flocculent, lack of polymer, mixing tank design, or something else.

By observing operation of the plant, and comparing it with results from the original treatability tests, Mr. Olewicz was able to show that the problems were not related to design of the plant, but to changed conditions in the inflow. Specifically, the suspended solids loading was significantly less than levels used in the treatability tests. Mr. Olewicz showed that the mechanical equipment was generally adequate, although a different impeller, and agitator and some minor piping changes might improve floc formation. Changing the alum addition with varying suspended solids loadings was the main recommendation to improve performance and reduce costs. Controlling pH, and covering the polishing filter to prevent clogging by algae growth, were additional recommendations. Finally, Mr. Olewicz noted that although the percent solids removal was less than designed for, the solids loading is even lower with the result that the discharge limits are being met. As long as discharge limits are met, no major design or operational changes are recommended.

h. Sagamore Marsh. Construction of the Cape Cod Canal in the 1930s caused significant degradation of the Sagamore Salt Marsh, located north of the canal. Before construction of the canal, the marsh was drained by the Scusset River, which flowed from the marsh into Cape Cod Bay. Dredged material from canal construction was placed in the marsh, filling portions of the Scusset river. To allow for runoff drainage, a southerly flowing channel was constructed connecting to the Cape Cod Canal. Circular culverts, 4 feet in diameter, were placed under road crossings. Construction of the canal, changed direction of the wetland drainage, and the subsequent restraint of tidal inflows by culvert construction altered physical conditions of the marsh, changing it from saltwater to freshwater.

Purpose of this study was to determine optimum culvert and channel configurations to restore as much of the marsh as possible without adversely affecting homes, yards, septic systems, or wells in the surrounding area. This was accomplished by estimating the frequency of flooding necessary to restore salt marsh, determining the effects of freshwater input, estimating an interior flood level which would not impact homes or yards, and determining the optimum culvert size to meet the objectives. This work was authorized under Section 1135 of the Water Resources Development Act of 1986, as amended.

The draft report, completed in FY95, showed that enlarging the existing culvert under each road crossing to 6 by 12-foot would be sufficient to restore approximately 50 acres of salt marsh. However, to prevent flooding of homes and roads, tide gates should be used to control inflows to the marsh for storms with frequencies of 10 years or greater. The final report is scheduled for release in FY96.

i. Storm Water Detention Basin Water Quality Study. In June, NED was requested by the Federally recognized Mashantucket Pequot Tribe to provide assistance under the Planning Assistance to States program. Extensive development at their reservation in connection with the Foxwoods Casino had created the need for storm water detention ponds to capture runoff from large parking lots. The tribe is concerned with the quality of the water leaving these basins during storms.

They requested assistance from the Corps in studying the effectiveness of constructed wetlands to improve water quality in the basins. In initial meetings with tribal representatives, NED gave assistance in study design. In FY96, the NED laboratory may perform water analyses on samples collected by the tribe from these basins.

j. DERP and Superfund Studies. The Defense Environmental Restoration Program (DERP), managed and operated by the Corps, examines former Department of Defense (DoD) properties for possible contamination due to DoD activities. The Superfund program cleans sites contaminated by industries. The U.S. Environmental Protection Agency (EPA) is in charge of Superfund; however, EPA is increasingly drawing on Corps engineering expertise in design and construction aspects of cleanups.

Water quality concerns are a major part of DERP and Superfund projects. Contaminated soil and groundwater are the most commonly encountered problems. Because of ground water mobility, water quality can be both the most important and most complicated aspect of cleanups. In FY95, EEHB was involved in design of plans for site safety and health, surface and groundwater quality monitoring, and treatment schemes for Superfund projects, including Baird and McGuire, Charles George Landfill, Nyanza Chemical Company, Groveland Wells, New Bedford Harbor PCB Cleanup, Norwood PCBs, and Silresim Industrial Site in Massachusetts; Union Chemical Company site in Maine; and Raymark Industries and Davis Liquid Waste in Rhode Island. DERP projects included Watertown Army Materials Testing Lab and Fort Devens in Massachusetts, and Quonset Naval Air Station and South Prudence Bay Island Park in Rhode Island.

k. Birch Hill Dam Landfill Investigation. The town of Royalston, Massachusetts, owned and operated a one-half acre dump at a site which is now part of the Birch Hill Dam flood control project. Landfill operations at the site ceased in the late 1930s when the Corps acquired the land and built the dam. Waste disposed of at this location was most likely municipal, but no records were kept by the town. In April 1995, Roy F. Weston, Inc., under contract to NED, completed a preliminary assessment report for the former dump site. Based on the proximity to drinking water wells, and PCB contamination in the Otter River, the former landfill was given a hazard ranking significantly greater than the 28.5 which marks a site as a hazardous waste site to be considered for cleanup under CERCLA.

NED is awaiting a decision by the Environmental Protection Agency (EPA) on how to proceed. Conversations with EPA indicate that agency considers the initial hazard to be overstated, and that the site will probably be dropped from the CERCLA list and recommended for cleanup under the Massachusetts Contingency Plan.

1. Other Landfill Investigations. There are three other landfills on NED property that are being investigated--the River Road site at Birch Hill Dam, a site behind the old operator's quarters at Tully Lake, and one at Otter Brook Lake. All are undergoing preliminary assessments to determine hazardous ratings. The Birch Hill and Tully landfills have received ratings of about five, indicating they are non-hazardous. However, Otter Brook's site received a higher rating, primarily based on its proximity to wetlands, and more extensive site investigations are likely. NED anticipates closing the landfills under agreements worked with the States. Closures at the Massachusetts projects should be fairly straightforward; the River Road site is below the dam at Birch Hill, and the Tully Lake site behind the operator's quarters is also protected from flooding. The Otter Brook Lake site is adjacent to a wetland, and the closure plan may be more complex.

5. CHANGES AT THE NED ENVIRONMENTAL LABORATORY

During FY95, the NED Lab became certified by the Connecticut Department of Public Health to perform drinking water analyses. The Lab was previously certified by Massachusetts and New Hampshire for these analyses. Vermont does not have a protocol for approving out-of-State labs, and relies on reciprocity with other States.

Completion of the HVAC system which supplies makeup air and exhaust for fume hoods in the new laboratories, was the final step in reconstruction of the laboratory building after the 1993 fire. The lab's personnel strength now stands at twenty-three, including five chemists, two biologists, and eight physical science technicians (see table 2).

The NED Lab strives to perform all environmental analyses in-house. Nevertheless, contract laboratories are used when the Lab lacks the capability for an analysis (all dioxin analyses were contracted to Alta Analytical Laboratory, Inc. in California) or cannot accommodate samples due to heavy workload (E3I in Somerville, and Standard Methods in Barre, Massachusetts were used for algal nutrients; e.g. nitrate and ammonia, and alkalinity). For legal compliance of drinking water monitoring, only labs certified for such may be used, necessitating the contracting out of such metals and organics to companies such as Alpha Analytical in Westboro, Massachusetts, while keeping the associated bacteriological testing in-house. In addition, in order to maintain the historic continuity of data or to facilitate comparison of data from the same geographic areas, analyses may be contracted out. Such was the case in using the Connecticut State Laboratory for fish tissue analyses in the West Thompson Lake study in order to ensure results would be comparable to those from other Connecticut lakes.

Quality is maintained through a rigorous program of QA/QC. EPA mandated requirements are followed for QA/AC for HTRW work (SW846). QA/QC for drinking water analyses are performed according to EPA requirements mandated by the Safe Drinking Water Act. For other analyses, QA/QC is carried out as required in the State Certification Requirements.

6. TRAINING AND ATTENDANCE AT WATER QUALITY MEETINGS AND CONFERENCES

In December, Mr. Donald Wood and Dr. Ian Osgerby attended a "LEAD" course in Danvers, Massachusetts.

An 8-hour refresher training course for Hazardous Waste Operations was completed by Environmental Laboratory personnel and most members of EEHB in March at NED.

In April, Mr. Townsend Barker attended a Corps Committee on Water Quality meeting in San Francisco, California.

North Atlantic Division's Annual Water Quality meeting was held in McHenry, Maryland, in June 1995. Mr. Barker represented NED, and gave a presentation on studies of possible fish contamination at West Thompson Lake in Connecticut.

In August, Mr. Barker attended a Combined Sewer Overflow Seminar in Boston.

7. WATER QUALITY RESEARCH/GUIDANCE NEEDS

Listed below are areas where NED's water quality programs and studies could benefit from research or guidance from Corps Labs or OCE.

- There is a need for Corps laboratories to provide more support for DERP and Superfund design related services, and for ongoing problem resolution where projects are currently experiencing operating difficulties.

- Environmental studies at NED will increasingly require use of sophisticated PC-based water quality models such as CEQUAL.ICM (see paragraph 8c). Training and technical assistance will be required in the use of these models. It is important that these models are made as user-friendly as possible.

- NED is working on several studies involving effects of storm water and combined sewer overflows on wetlands, especially coastal wetlands, and the effects of wetlands on these discharges. Research and design guidance on work in these areas would be useful.

8. USE OF CORPS LABS IN FY95

a. Nyanza Superfund Site. During FY95, personnel from the Waterways Experiment Station's (WES) Hydraulics Laboratory continued their studies at the Nyanza Superfund site. They were involved in modelling sediment transport in the Sudbury River near Ashland, Massachusetts. Results of this study will be used to locate areas where high levels of contaminated sediment are likely to be found, and predict effects of possible remedial actions such as capping. Field data collection and most of the modelling were completed by the end of FY95. In FY96, final computer runs and reports will be completed.

b. Charles George Superfund Site. WES assisted NED in dealing with groundwater and leachate extraction wells at this site that were clogged with iron bacteria and precipitated iron. Under WES guidance, and utilizing a contractor who is a specialist in this type of work, the well field has undergone a rehabilitation process as a first step in a regular program of well maintenance.

c. Muddy River Study. Mr. Donald Wood spent two weeks at the WES Environmental Laboratory in FY95 learning to use CEQUAL-ICM. This is an advanced, 3-dimensional eutrophication model needed for evaluation of water quality conditions and remedies for the Muddy River in Boston.

9. DISTRIBUTION LIST

a. Corps of Engineers

Division Engineer
Director of Engineering
Director of Operations
Chief, Public Affairs Office
Upper Connecticut River Basin Manager
Lower Connecticut River Basin Manager
Thames River Basin Manager
Naugatuck River Basin Manager
Merrimack River Basin Manager
Chief, Water Control Division
Chief, Operations Technical Support Division
Chief, Impact Analysis Division
Chief, Geotechnical Engineering Division
Director, Environmental Laboratory
Chief, Environmental Laboratory Safety Officer
Mr. Levitt
Mr. Williams
Mr. Barker
Mr. Hays

b. Non-Corps

Ms. Rebecca Callahan
NED Coordinator/Massachusetts
Governor's Office of Economic Development
Room 109, State House
Boston, MA 02133-1010

Mr. Jeffrey H. Taylor, Director
NED Coordinator/New Hampshire
Office of State Planning
2-1/2 Beacon Street
Concord, NH 03301-4497

Mr. Bernard P. Johnson
NED Coordinator/Vermont
Office of Policy Research and Coordination
109 State Street
Montpelier, VT 05602-2700

Mr. William Ferdinand
NED Coordinator/Maine
State Planning Office
Coastal Program/Outer Continental Shelf
State House Station #38
184 State Street
Augusta, ME 04333-0001

Mr. Robert Griffith, Executive Director
NED Coordinator/Rhode Island
Water Supply Coordinating Council
Division of Planning/DOA
1 Capitol Hill
Providence, RI 02908-5870

Mr. Horace H. Brown
NED Coordinator/Connecticut
Under Secretary, Comprehensive Planning Division
Office of Policy and Management
80 Washington Street
Hartford, CT 06106-4458

Mr. Robert Smith
Water Compliance Unit
Connecticut Department of Environmental Protection
122 Washington Street
Hartford, CT 06106-4405

Director
Water Management Branch
U.S. Environmental Protection Agency
J.F. Kennedy Federal Building
Boston, Massachusetts 02203

Mr. Thomas Willard
Vermont Agency of Natural Resources
Department of Environmental Conservation
Montpelier, VT 05602

Mr. Russell Isaac
Massachusetts Division of Water Pollution
Control
One Winter Street,
Boston, Massachusetts 02108

Director and Chief Engineer
Massachusetts Division of Water Resources
Leverett Saltonstall Building
100 Cambridge Street
Boston, MA 02202-0001

Chairman
New Hampshire Department of Environmental Services
Water Resources Division
64 North Main Street
Concord, NH 03301-4913

Commissioner
Department of Environmental Protection
State Office Building
Hartford, CT 06106

Mr. Karl L. Jurenthuff
Department of Environmental Conservation
Building 10N
103 South Main Street
Waterbury, VT 05671-0408

Director
State of New Hampshire Fish and Game Department
2 Hazen Drive
Concord, NH 03301-6507

Ms. Nancy Brown
Connecticut River Watershed Council, Inc.
One Ferry Street
Easthampton, MA 01027

APPENDIX A

RESERVOIR WATER QUALITY CONTROL MANAGEMENT REPORTS
NEW ENGLAND DIVISION

Appendix A

Reservoir Water Quality Control Management Reports
New England Division
(Prepared through FY95)

Project	Report and Date
Connecticut.	
Black Rock Lake	Black Rock Lake Water Quality Evaluation, June 1983.
Colebrook River Lake	Colebrook River Lake Water Quality Evaluation, June 1983. Colebrook River Lake Dissolved Gas Supersaturation Study, August 1984.
Hancock Brook Lake	Hancock Brook Lake Water Quality Evaluation, June 1983.
Hop Brook Lake	Hop Brook Lake Water Quality Evaluation, April 1983. Hop Brook Lake Water Quality Evaluation Update, August 1984 Hop Brook Lake Nutrient Balance Study, August 1987. Hop Brook Lake Fisheries Assessment, April 1987. Hop Brook Lake Destratification Study, August 1985. Hop Brook Lake Summary of Limited Biological Survey, May 1981. Hop Brook Lake Close Interval Sampling, Sediment and Algal Progression Study, May 1990. Hop Brook Lake Water Quality Study (Interim Report), June 1990. Hop Brook Lake Water Quality Study (Interim Report), April 1993. Hop Brook Lake, Connecticut, Priority Pollutant Scan, August 1993.
Mansfield Hollow Lake	Mansfield Hollow Lake Water Quality Evaluation, June 1983 Mansfield Hollow Lake Water Quality Evaluation, July 1988.
Northfield Brook Lake	Northfield Brook Lake Water Quality Evaluation, January 1983 Priority Pollutant Scan of an Unnamed Brook at Northfield Brook Lake July 1992
Thomaston Dam	Thomaston Dam Water Quality Evaluation, April 1983 Brown Trout Habitat Suitability at Thomaston Dam, Connecticut, February 1987. Limnological Survey at Thomaston Dam, Connecticut, March 1987. Thomaston Dam, Water Quality Evaluation, June 1991. Thomaston Dam, Connecticut, Priority Pollutant Scan, August 1994.
West Thompson Lake	A Biological and Chemical Survey of Algal Blooms at West Thompson Lake, Connecticut, August 1979. West Thompson Lake Water Quality Evaluation, April 1983. West Thompson Lake Water Quality Evaluation Update, June 1984. Final Report on the West Thompson Lake Algae Control Study, June 1986. West Thompson Lake, Connecticut, Priority Pollutant Scan, December 1994.

Massachusetts.

Barre Falls Dam	Barre Falls Dam Water Quality Evaluation, June 1983. Barre Falls Dam, Massachusetts, Priority Pollutant Scan, January 1995.
Birch Hill Dam	Birch Hill Dam Water Quality Evaluation, April 1983. Birch Hill Dam Water Quality Evaluation, July 1987. Birch Hill Dam, Priority Pollutant Scan, Interim Report, July 1988. Birch Hill Reservoir PCB Investigation, July 1989 Birch Hill Reservoir PCB Investigation, September 1990 Birch Hill Reservoir PCB Investigation, Phase I, October 1991. Birch Hill Reservoir PCB Study, March 1992
Buffumville Lake	Buffumville Lake Water Quality Evaluation, January 1983. Buffumville Lake Water Quality Evaluation Update, May 1984. Buffumville Lake Water Quality Evaluation, August 1985. General Limnological Survey, Buffumville Lake, 1985.
Charles River NVSP	Charles River NVSP Water Quality Assessment, June 1987.
Conant Brook Dam	Conant Brook Dam Water Quality Evaluation, June 1983.
East Brimfield Lake	General Limnological Survey, The East Brimfield Project/Lake 1982. East Brimfield Lake Water Quality Evaluation, January 1983. East Brimfield Lake Water Quality Evaluation Update, September 1984.
Hodges Village Dam	Hodges Village Dam Water Quality Evaluation, April 1983.
Knightville Dam	Knightville Dam Water Quality Evaluation, June 1983. Knightville Dam Fishery Assessment, Huntington, Massachusetts, May 1989
Littleville Lake	Littleville Lake Water Quality Evaluation, January 1983. Fisheries Assessment, Littleville Lake, 1987.
Tully Lake	Tully Lake Water Quality Evaluation, June 1983 Tully Lake Evaluation of Effects of Flood Control Project Operations on Water Quality, September 1984.
West Hill Dam	West Hill Dam Water Quality Evaluation, April 1983.
Westville Lake	Westville Lake Water Quality Evaluation, January 1983.

New Hampshire.

Blackwater Dam	Blackwater Dam Water Quality Evaluation, June 1983.
Edw. MacDowell Lake	Edw. MacDowell Dam Water Quality Evaluation, January 1983.
Everett Lake	Everett Lake Water Quality Evaluation, September 1982. Everett Lake Water Quality Evaluation, January 1983
Franklin Falls Dam	Franklin Falls Dam Water Quality Evaluation, April 1983. Franklin Falls Dam Water Quality Evaluation, April 1984 General Limnological Survey, Franklin Falls Dam, 1984.
Hopkinton Lake	Hopkinton Lake Water Quality Evaluation, September 1982. Hopkinton Lake Water Quality Evaluation, April 1983 Elm Brook Pool Water Quality Evaluation, September 1982. Hopkinton Lake, Priority Pollutant Scan, June 1988.
Otter Brook Lake	Otter Brook Lake Water Quality Evaluation, April 1983. Otter Brook Lake Evaluation of Effects of Flood Control Project Operations on Water Quality, May 1984. Otter Brook Lake, New Hampshire Fisheries Assessment, November 1987. Otter Brook Lake, New Hampshire, Priority Pollutant Scan, February 1993
Surry Mountain Lake	Surry Mountain Lake Water Quality Evaluation, June 1983 Surry Mountain Lake, New Hampshire Fisheries Assessment, Nov. 1987.

Vermont.

Ball Mountain Lake	Ball Mountain Lake Water Quality Evaluation, August 1982. Ball Mountain Lake Water Quality Evaluation, June 1983. Ball Mountain Lake Water Quality Evaluation, September 1987.
North Hartland Lake	North Hartland Lake Water Quality Evaluation, August 1982. North Hartland Lake Water Quality Evaluation, January 1983. North Hartland Lake Water Quality Evaluation, September 1986. Smallmouth and Largemouth Bass Suitability at North Hartland Lake, Vermont, November 1987.
No. Springfield Lake	North Springfield Lake Water Quality Evaluation, August 1982. North Springfield Lake Water Quality Evaluation, April 1983. Stoughton Pond at North Springfield Reservoir Water Quality Evaluation, August 1982. North Springfield Lake Fishery Assessment, North Springfield and Weathersfield, Vermont, May 1989
Townshend Lake	Townshend Lake Water Quality Evaluation, September 1982. Townshend Lake Water Quality Evaluation, June 1983. Atlantic Salmon Suitability at Townshend, Vermont, November 1987.
Union Village Dam	The Effects of Mine Drainage at the Union Village Project, (A Preliminary Biological and Chemical Survey), March 1980. Union Village Dam Water Quality Evaluation, January 1983. Union Village Dam Water Quality Evaluation Update, August 1984. Union Village Dam Water Quality Evaluation, September 1989.

General.

Effects of Acid Precipitation on NED Projects (Interim Report), November 1984.

Effects of Acid Precipitation on NED Projects (Interim Report), July 1989

Class II Water Quality Projects With Pools, Water Quality Evaluation Update, September 1985.

Class III Water Quality Projects, Water Quality Evaluation Update, October 1985.

Class III Water Quality Projects, Water Quality Evaluation Update, August 1986

Class II Dry-Bed Reservoir Projects, Water Quality Evaluation Update, September 1986.

Class III Water Quality Projects, Water Quality Evaluation Update, August 1988.

Class I Water Quality Projects, Water Quality Evaluation Update, August 1988.

Class III Water Quality Projects with Permanent Pools, Water Quality Evaluation Update, Sept 1989.

Class II Water Quality Projects with Permanent Pools, Water Quality Evaluation Update, Sept 1989

APPENDIX B

CURRENT WATER QUALITY ENGINEERING REGULATION
NEW ENGLAND DIVISION

D R A F T

29 March 1982

ENGINEERING AND DESIGN
WATER QUALITY PROGRAM ACTIVITIES
POLICY AND RESPONSIBILITY

1. Purpose: To define policy and assign responsibilities in the New England Division for water quality activities related to planning, design, construction. and operation and maintenance of Civil Works Projects.

2. Applicability: The policies and responsibilities defined in this regulation are applicable to all organizational elements of this command.

3. References:

a. ER 10-1-3, "Organization and Functions," 1 May 1968.

b. ER 1110-2-1402, "Hydrologic Investigation Requirements for Water Quality Control," 15 September 1978.

c. ER 1110-2-1150, "Post-Authorization Studies," (as amended by ER 1105-2-920, 31 August 1978), 1 October 1971.

d. ER 1110-2-XXX, "Draft Engineering Regulation" providing interim guidance for water control management, transmitted by EC 1110-2-208, 30 July 1979.

e. ER 1130-2-407, "Operating and Testing Potable Water Systems in Compliance with the "Safe Drinking Water Act" (Public Law 93-523)," 10 June 1977.

f. ER 1130-2-415, "Water Quality Data Collection, Interpretation, and Application Activities," 28 October 1976.

g. ER 1130-2-334, "Reporting of Water Quality Management Activities at Corps Civil Works Projects," 16 December 1977.

Supersedes NEDER 1110-1-6, 2 March 1979

h. ER 1110-1-8100, "Laboratory Investigations and Materials Testing," 30 August 1974.

i. ER 1110-1-261, "Control of Field Testing Procedures," 28 September 1979.

4. Policy: It is New England Division policy that the quality of water be protected or enhanced at Civil Works projects and activities. This applies to all water environments, whether riverine, lacustrine, estuarine or marine. Execution will be through a program of water quality control which is carried through the planning, environmental impact analysis, engineering and design, construction and operation phases of a project.

5. Responsibilities for the involved functional elements are as follows:

a. Engineering Division. Responsible for management of the water quality program. Appropriate engineering and scientific staff will be used to carry out design of sampling programs, field sampling, field analysis, laboratory analysis, data evaluation and interpretation, water quality analysis and prediction, water quality control engineering and design, and reservoir water quality control management activities. Included is the responsibility to determine water quality information and study needs and to plan, budget and schedule for these activities.

b. Planning Division. Responsible for incorporating water quality considerations in planning investigations and environmental impact statements and assessments. Project managers are responsible for coordinating schedules and budgets with Engineering Division for the water quality activities stated in 5a, above.

c. Operations Division. Responsible for incorporating water quality considerations in reservoir project operations, including recreation management, fishery management and potable water supply. Program/project managers are responsible for coordinating schedules and budgets with Engineering Division for the water quality activities stated in 5a.

d. Construction Division. Responsible for insuring contractor compliance with the water quality protection features of project plans and specifications. Resident engineers are responsible for informing Engineering Division of the emergence of water quality problems at construction sites and of any complaints received from State or local officials.

6. Organization: The following organizational elements will carry out the water quality program:

a. Water Control Branch will conduct and/or direct all in-house or contracted studies and activities related to water and associated sediment quality considerations in river, reservoir, lake, harbor, estuary and ocean projects or programs. Engineering and scientific services provided include scoping water quality investigations, determination of data needs and design of data collection programs, data storage and retrieval, data evaluation and interpretation, water quality prediction, water quality control engineering and reservoir water quality control management. The Water Control Branch will establish and maintain the NED quality assurance program for all in-house and contracted field sampling and laboratory analysis services.

b. NED Materials and Water Quality Laboratory will provide laboratory services for both fresh and salt waters and associated sediments including physical, chemical and biological analysis of samples, the quality control evaluation of the results and the compilation and transmittal of data. It also will provide field services for fresh water and associated sediment sampling and in-situ measurements. The Laboratory is responsible for the contracting of services to be provided by other Government and commercial laboratories including the technical supervision and inspections that form a part of the NED quality assurance program.

7. Approved for use on an interim basis pending full staff coordination and official approval.

Date 26 March 1982

C. E. Edgar III

C. E. EDGAR III
Colonel, Corps of Engineers
Commanding

APPENDIX C

EXPLANATION OF NED RESERVOIR PROJECT WATER QUALITY CLASSIFICATION SYSTEM

EXPLANATION OF NED RESERVOIR PROJECT WATER QUALITY CLASSIFICATION SYSTEM

The 31 projects maintained and operated by NED are grouped into three categories, based on past and present water quality conditions. Five factors are used in the assignment of classes: (1) statements of project conditions in past NED Annual Water Quality Reports, (2) State Water Quality Reports, including information on upstream watershed activity, (3) identifiable changes between inflow and discharge water quality, (4) frequency of violation of water quality criteria, and (5) existence of a conservation pool.

Simply stated, class I projects have high water quality, class II projects have minor or suspected water quality problems, and class III projects experience continuing water quality problems. Low level, fixed station monitoring is applied at class I and class II projects, and high level monitoring is applied at class III projects. Class III projects have the highest priority for intensive surveys or other special studies, and class II projects have a low priority. No intensive surveys are planned for class I projects.

APPENDIX D

STATE WATER QUALITY CLASSIFICATIONS
NED PROJECTS

STATE WATER QUALITY CLASSIFICATIONS OF NED RESERVOIR PROJECTS

Project	State	Classification
Ball Mountain Lake	VT	B
Barre Falls Dam	MA	A
Birch Hill Dam	MA	B
Black Rock Lake	CT	B
Blackwater Dam	NH	B
Buffumville Lake	MA	B
Colebrook River Lake*	MA	A
Colebrook River Lake	CT	AA
Conant Brook Dam	MA	A
East Brimfield Lake	MA	B
Edward MacDowell Lake	NH	B
Everett Lake	NH	B
Franklin Falls Dam	NH	B
Hancock Brook Lake	CT	B
Hodges Village Dam	MA	B
Hop Brook Lake	CT	B
Hopkinton Lake	NH	B
Knightville Dam	MA	B
Littleville Lake	MA	A
Mansfield Hollow Lake	CT	AA
Northfield Brook Lake	CT	B
North Hartland Lake	VT	B
North Springfield Lake	VT	B
Otter Brook Lake	NH	B
Surry Mountain Lake	NH	B
Thomaston Dam	CT	B
Lead Mine Brook	CT	A
Townshend Lake	VT	B
Tully Lake	NH	B
Union Village Dam	VT	B
West Hill DAm	MA	B
West Thompson Lake	CT	C
Westville Lake	MA	B

*Colebrook strattles the Massachusetts/Connecticut border.